

ELECTRONIC HANDHELD AUDIO/VIDEO RECEIVER AND LISTENING/VIEWING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

This document is a continuation-in-part and claims priority to: (1) copending non-provisional U.S. patent application entitled "Video/Audio System and Method Enabling a User to Select Different Views and Sounds Associated With an Event," assigned serial number 09/322,411, and filed May 28, 1999; (2) copending non-provisional U.S. patent application entitled "Audio/Video System and Method Utilizing a Head Mounted Apparatus With Noise Attenuation," assigned serial number 09/386,613, and filed August, 31, 1999, both of which are incorporated herein by reference. This document also claims priority to and the benefit of the filing date of the copending provisional application "Electronic Handheld Video Receiver and Viewing Device," assigned serial number 60/240,129, and filed October 13, 2000, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention generally relates to an apparatus for processing video and/or audio signals and for displaying images and producing sounds based on the processed video and/or audio signals.

RELATED ART

Audio and video signals are generated from a plurality of sources during many events.

An "event" is any occurrence viewed by a spectator. For example, at a football game or other type of sporting event, television crews usually position cameras and microphones at various locations in the stadium. As used herein, "stadium" shall be defined to mean any non-movable structure having a large number (*i.e.*, thousands) of seats, wherein an event occurs at (*i.e.*, within a close proximity of) the seats such that spectators sitting in the seats can view and hear the event. These crews generate audio and video signals defining views and sounds of the football game from various perspectives.

One of the video signals and one of the audio signals are usually selected at a television station to form a combined audio/video signal. This signal is then modulated and transmitted so that users having a television can receive the signal via the television. The television demodulates the combined signal and displays an image defined by the video signal on a display screen and reproduces the sounds defined by the audio signal via speakers. Therefore, the sights and sounds of the game can be viewed and heard via the television.

However, spectators viewing and/or hearing the sights and sounds of the game via televisions are not usually given the opportunity to select which video and/or audio signals are modulated and transmitted to the television. Therefore, the spectator is only able to receive the signals modulated and transmitted to the television, even though the spectator may prefer to receive the other signals that are generated at the game.

Spectators who actually attend the sporting event are usually given more options to view and/or hear the sights and sounds of the sporting event from different perspectives. In this regard, one or more monitors are sometimes located at one or more locations in the stadium.

Each monitor within the stadium receives one of the aforementioned video signals and displays an image defined by the received video signal to many of the spectators. However, the monitor does not always display a desirable perspective with respect to each spectator in the stadium, and the monitor is often not located in a convenient location for many of the spectators. In this regard, many of the spectators often must leave their seats (or other locations) in the stadium and go to a location where the spectators, along with other spectators, can view the monitor displaying the desired perspective. The spectators viewing the monitor often do not have control over which image is displayed by the monitor.

Thus a heretofore unaddressed need exists in the industry for providing a system and method that enables a spectator to conveniently view an event from different perspectives.

SUMMARY OF THE INVENTION

The present invention overcomes the inadequacies and deficiencies of the prior art as discussed hereinbefore. Generally, the present invention provides a system and method for providing a user with a plurality of audio and video signals defining different sounds and views associated with an event.

The present invention includes a handheld device having a video receiver, a virtual image display device, and one or more speakers. The virtual image display device produces virtual visual images based on received video signals, and the speakers produce sounds based on the received audio signals. As a result, the user may hear the sounds produced by the speakers and may see the video images produced by the display device by holding the handheld device to the user's face, or the user may watch the event live by removing the handheld device from the user's face.

In accordance with another feature of the present invention, the handheld device incorporates an integrated light shield/shroud to block ambient light that can interfere with the user's ability to view the virtual image. Unlike individual eye shrouds characteristic of a pair of optical binoculars, the present shroud shields both eyes at the same time. Among other advantages, the present shroud enables the user to operate the device while wearing eyeglasses or sunglasses.

Other features and advantages of the present invention will become apparent to one skilled in the art upon examination of the following detailed description, when read in conjunction with the accompanying drawings. It is intended that all such features and advantages be included herein within the scope of the present invention and protected by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other, emphasis instead being placed upon clearly illustrating the principles of the invention. Furthermore, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a block diagram illustrating a video/audio receiving system in accordance with the present invention.

FIG. 2 is a block diagram illustrating more detailed view of a virtual image display system depicted in FIG. 1.

FIG. 3 is a three dimensional side view of an exemplary handheld device for implementing the video/audio receiving system of FIG. 1.

FIG. 4 is a top view of the exemplary handheld device depicted in FIG. 3.

FIG. 5 is a three dimensional front view of the exemplary handheld device depicted in FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described hereafter in the context of football game applications. However, the scope of the present invention should not be so limited, and it should be apparent to one skilled in the art that the principles of the present invention may be employed in the context of other applications, particularly in the context of other sporting events (*e.g.*, auto races, basketball games, baseball games, hockey matches, *etc.*).

FIG. 1 depicts a video/audio receiving system 12 implementing the principles of the present invention. At least one video signal 14 and at least one audio signal 15 are received by a receiver 16. Each of the video signals 14 defines a view of the event from a different perspective. For example, the video signals 14 may be generated by different video cameras located at different locations around the stadium. Furthermore, each of the audio signals 15 defines different sounds associated with the game. For example, at least one of the audio signals 15 may be generated from a microphone located close to the sideline of the game or in one of the helmets of one of the players of the game such that the audio signal defines sounds from the participants in the game. Alternatively, at least one of the audio signals 15 may define the comments of television commentators, and at least one of the audio signals 15 may define the comments of radio commentators.

In particular, at least one of the audio and one of the video signals may be transmitted as a single combined signal from an audio/video system described in U.S. patent application

09/322,411 entitled "Video/Audio System and Method Enabling a User to Select Different Views and Sounds Associated With an Event." Additionally, one or more of the video and/or audio signals may be wireless, in which case, the interface 18 may comprise an antenna for receiving the wireless signals. However, various other types of signal interfaces 18 are possible.

5 For example, the signal interface 18 may be a cable or other type of signal transmission apparatus. Any type of wireless and/or non-wireless technique may be used to transmit signals to the video and audio receiver 16 via the signal interface 18.

Some of the audio and video signals 15 and 14 can be unmodulated when transmitted to the receiver 16 through the signal interface 18 and, therefore, do not need to be demodulated by the system 12. However, some of the audio signals 15 and/or video signals 14 may be modulated when received by the receiver 16 and, therefor, may need to be demodulated by the system 12. For example, at least one of the audio signals 15 defining the comments of the radio commentators may be modulated as a radio signal for transmission to radios located at or away from the stadium, and at least one of the video signals 14 may be modulated as a television signal for transmission to televisions located at or away from the stadium. Therefore, as shown by FIG. 1, the system 12 preferably includes a demodulator 20 configured to demodulate any modulated audio signals 15 and/or video signals 14 received by the receiver 16 through the signal interface 18.

Once demodulated, if necessary, the audio and video signals 15 and 14 are processed by signal processing logic 22, which selects and conditions the signals 15 and 14. More specifically, the signal processing logic 22 selects, based on inputs from the user, one of the audio signals 15 and one of the video signals 14. Note that the logic 22 may be implemented via hardware, software, or a combination thereof. Further, the logic 22 may include one or more

filters for filtering out the unselected signals 15 and 14. After selecting one of the audio and video signals 15 and 14, the logic 22 conditions the selected video signals 15 so that they are compatible with the virtual image display system 30, and the logic 22 conditions the selected audio signals 15 so that they are compatible with the speakers 34. The logic 22 then transmits the conditioned audio signals 15 to the speakers 34, which converts the conditioned audio signals 15 into sound. The logic 22 also transmits the conditioned video signals 14 to the virtual image display system 30, which displays the image defined by the conditioned video signals 14 according to techniques known in the art. Note that the processing performed by the signal processing logic 22 may be similar to or identical to the processing performed by the system in U.S. patent application 09/322,411 entitled "Video/Audio System and Method Enabling a User to Select Different Views and Sounds Associated With an Event."

An input device 24, which may comprise one or more buttons knobs, dials, or other types of switches, may be used to provide the inputs for the processing performed by the processing logic 22. By controlling the components of the input device 24, the user may control various aspects of the processing performed by the logic 22, including which video signals 14 are selected for viewing, as well as which audio signals 15 are heard and the volume of the audio signals 15.

FIG. 2 depicts an exemplary virtual image display system 30 that may be employed to implement the principles of the present invention. A processed video signal 14 is displayed onto a Liquid Crystal Display 34. The Liquid Crystal Display 34 may be lit from the back via a back light 36, with the light shining through the Liquid Crystal Display 34, creating an image on the other side of the Liquid Crystal Display 34. On the opposite side of the Liquid Crystal Display 34 from the back light 36, some distance from the Liquid Crystal Display 34, is a half-silvered

mirror 38. The half-silvered mirror 38 is set at an approximately forty-five degree angle from the Liquid Crystal Display 34. The image reflects off the half-silvered mirror 38 onto a separate curved mirror 40 set some distance away from the half-silvered mirror 38. The curved mirror 40 magnifies the virtual image. The magnified virtual image reflects off of the curved mirror 40, back to the half-silvered mirror 38. The magnified virtual image passes through the half-silvered mirror 38 to a lens 42 located on the opposite side of the half-silvered mirror 38 from the curved mirror 40. The magnified virtual image passes through the lens 42, which focuses the magnified virtual image. When the handheld device 50 is held to the user's face and the user 44 looks into the lens 42, the magnified virtual image is observed by the user 44. The user 44 observes the magnified virtual image as much greater in size than the actual size of the image on the Liquid Crystal Display 34, with said magnified virtual image appearing to the user 44 to be located several feet in front of the user 44. It should be noted that other embodiments of the virtual image display system 30 may be employed without departing from the principles of the present invention. For example, in some embodiments, a single prism can be used to replace components 38, 110, and 112.

In the preferred embodiment, the receiver 16, signal processing logic 22, virtual display system 30, and speakers 34 are all embodied within a handheld device 50, which is discussed in further detail herein below. Note that the handheld device 50 may be comprised of a housing unit or a casing coupled to each of the components shown in FIG. 1. One or more of the components may be housed within the casing. By utilizing a handheld device 50 for viewing video signals 14, the user's experience may be enhanced. For example, when a handheld device 50 is used to show a field view of the game from a camera located on another side of the stadium, the user 44 sees a similar view as spectators located in that portion of the stadium.

Because the handheld device 50 limits the user's peripheral view of the environment around him, the user 44 naturally focuses on the view provided by the handheld device 50. When the user 44 desires to view the game directly, the user may quickly lower the device 50 so that the user's view of the game is not obstructed by the device 50. The handheld device 50 may similarly enhance a user's experience at other events, such as other sporting events, for example.

Furthermore, since the device 50 is handheld, the device 50 is easily portable, and the user 44 may carry the handheld device 50 with him and choose where he would like to view the images produced by the handheld device 50. Indeed, the user 44 may roam the stadium with the device 50 in hand while intermittently viewing the images and hearing the sounds produced by the system 12. Furthermore, by manipulating buttons or other types of switches 56 in the user input 24, the user 44 may control which video signals 14 are displayed and which audio signals 15 are produced by the system 12. Accordingly, the handheld device 50 gives the user 44 more flexibility in how the user 44 observes and listens to the sporting event and, as a result, makes the event a more enjoyable experience.

Many different types of casings for the handheld device 50 may be employed to implement the present invention. FIGS. 3, 4 and 5 depict an exemplary handheld device 50.

As depicted in FIG. 3, the handheld device 50 includes a main component 52, containing the system 12 (FIG. 1) used to provide a virtual image to the user 44, as discussed hereinbefore. The handheld device 50 also includes a shroud 54 to block out ambient light. The shroud 54 is adapted to receive the user's forehead and allows the handheld device 50 to be engaged with the user's forehead while the user 44 is wearing eyeglasses or sunglasses. As can be seen in FIG. 5, the shroud 54 is shaped and sized to completely cover the user's eyes, allowing the handheld device 50 to be held against the face and/or forehead comfortably and blocking ambient light.

Also as a result, there is an amount of space between the eye position of the user 44 and the lenses 42 which reside in front of the user's eyes sufficient to accommodate the user's eyeglasses, *e.g.*, about one inch or more (in one embodiment, about 25 mm).

As depicted in FIG. 4, one or more switches 56 can be placed on the outside of the handheld device 50 for manipulation by the user 44 when the handheld device 50 is held to the user's face and/or forehead. Such switches 56 may include a rocker switch used to provide control of a parameter which varies through a range, such as channel selection. Other items that could be controlled in this fashion include, but are not limited to, tint, hue or contrast of the image, image brightness, volume control and the like. A slider switch (not shown) can be used, *e.g.*, to select among discrete choices. For example, the slider switch (not shown) may be used to select left, right or no relative frame phasing, to select between stereo and non-stereoscopic views, *etc.* Other controls and/or indicators can also be used and can be mounted on various surfaces of the handheld device 50 of FIG. 4.

It should be noted that it is not necessary for the user 44 to keep the handheld device 50 within the stadium. In this regard, the audio and video signals 15 and 14 may be transmitted via satellites and/or communication networks to various locations around the world, and the user 44 may select the view he prefers the most from just about any location capable of receiving a video signal 14 and/or audio signal 15.

It should also be noted that the handheld device 50 may be retrieved from the user 44 after the user 44 is finished viewing the event so that the handheld device 50 can be provided to another spectator for another event at the stadium. Each user 44 may be charged a usage fee for the user's use of the handheld device 50. In some embodiments, payment of the fee may be required before the user 44 is provided with the device 50. In other embodiments, the device 50

may receive information, via signals 14 and/or 15 or otherwise, indicating whether the device 50 is authorized to produce sounds and images defined by the signals 14 and 15. In this embodiment, the device 50 is configured to produce such images and sounds only when authorized to do so, and such authorization should only be transmitted to the device 50 once the user 44 of the device 50 has provided payment.

It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without departing substantially from the spirit and principles of the invention. All such modifications and variations are intended to be included herein within the scope of the present invention and protected by the claims.